

TITLE: Bridge Inspection and Evaluation Procedure

1. EFFECTIVE DATE: (date to be added later)

2. CANCELLATION: This procedure supersedes the previous version of the *Real Property Branch Bridge Inspection and Evaluation Procedure* which came into effect on January 20, 2009.

3. AUTHORITY

This procedure is issued under the authority of the Assistant Deputy Minister (ADM), Real Property Branch (RPB), Public Works and Government Services Canada (PWGSC).

4. CONTEXT

This procedure is issued with the framework of, and should be read in conjunction with, the *Bridge Inspection and Evaluation Policy* (date to be added later).

5. SCOPE

This procedure applies to all bridges under the custodianship of PWGSC and to work performed by both in-house resources and private sector consultants on these bridges. For bridges on dams, the *RPB Dam Inspection and Evaluation Policy* also applies.

6. PURPOSE

To ensure, in the interest of public safety and long-term stewardship of the assets, that PWGSC bridges are maintained to a level of service consistent with accepted industry practices, codes, and standards.

7. PROCEDURE DETAILS

7.1 Bridge Inspections

All bridge inspections shall be carried out in accordance with the current edition of the *PWGSC Bridge Inspection Manual* (BIM), including any additional approved procedures relevant to the particular bridge to be inspected and evaluated. Bridges shall be inspected as outlined in Table 1.

TABLE 1: BRIDGE INSPECTIONS

	Inspection Type	Minimum Frequency	Applicable To	Inspection By (see section 9 for definitions)
1	Comprehensive Detailed Inspection*	2 Years (alternate year with General Inspection)	All Bridges (except Movable Bridges)	Qualified Bridge Engineer (QBE) or trained Bridge Inspector under the supervision of a QBE
		Annual	Movable Bridges	
2	General Inspection*	2 Years (alternate year with Comprehensive Detailed Inspection)	All Bridges (except Movable Bridges)	QBE or trained Bridge Inspector under the supervision of a QBE
3	Maintenance Inspection/Patrol	Monthly	All Bridges	Field maintenance personnel under the direction of an Engineer
4	Underwater Inspection*	4 Years	All Bridges over water with pier or abutment in water	Experienced Diver under the direction of a QBE
5	Specialized Component Inspection	Annual	Moveable Bridges	Qualified Specialist Engineer
6	Monitoring Inspection	As required	Generally one or more components of a Bridge	Qualified/trained personnel under the direction of a QBE
7	Special Inspection	As required	All Bridges	Qualified/trained personnel under the direction of a QBE
8	Condition Inspection	As required	All Bridges, Load Capacity Evaluation	QBE
9	New Bridge Inspection	See Section 7.1.1	All Bridges except Moveable Bridges and Suspension Bridges	QBE or trained Bridge Inspector under the supervision of a QBE

* Bridge components that are normally underwater shall be inspected at least once every four (4) years. Bridge components that are normally underwater but are accessible above water due to dry or very low water levels shall be inspected as part of the Comprehensive Detailed Inspection or General Inspection. The observations and any related comments shall be documented in the inspection report.

The inspection frequencies outlined in Table 1 are the **minimum requirements** and apply to structures in good repair.

Additional inspections may be required depending upon age, traffic characteristics, state of maintenance, type of structure, location, climate, operational deficiencies, strategic importance of the structure, known component deficiencies, specialized functional mechanisms, and operational critical conditions.

The following structures or components may require more frequent inspections:

- Structures with a high proportion of components rated as being in poor condition (condition and/or performance rating 3 or lower as defined in the BIM)
- Load-posted structures
- Structures with fatigue and fracture-prone details
- Single load path structures
- New types of components or details with no previous history

The additional inspections shall be scheduled and carried out by qualified personnel as listed in Table 1. The recommendations and reasons for additional inspections shall be clearly noted in the inspection report.

7.1.1 Inspection of a New Bridge

For a newly constructed bridge, a Comprehensive Detailed Inspection (including Underwater Component Inspection) shall be carried out at the end of the guarantee maintenance period which is typically after the first year of service. This inspection shall serve as a benchmark for all future inspections.

Following this inspection, a General Inspection shall be carried out annually from year two to year nine. In year 10, a Comprehensive Detailed Inspection shall be carried out. After year 10 the inspection schedule shall follow the requirements of Table 1. (Comprehensive Detailed Inspection and General Inspection in alternating years)

However, should any significant deficiencies be discovered during a General Inspection in year 2 to year 9 (condition rating below 5) in the primary or secondary components, then a Comprehensive Detailed Inspection shall be carried out the following year.

The *General Inspection Report* must include the Engineer's recommendation as to whether a Comprehensive Detailed or General Inspection is required for the following year. The Engineer must outline the reasons as to why a Comprehensive Detailed Inspection is warranted. If the Engineer recommends a Comprehensive Detailed Inspection for the following year, then for subsequent years the annual inspection shall alternate between a General Inspection and a Comprehensive Detailed Inspection, as indicated in Table 1.

This section does not apply to a moveable bridge or a suspension bridge. This type of bridge shall follow the schedule as outlined in Table 1.

7.2 Structural Evaluation (Load -Carrying Capacity)

A structural evaluation is required if 10 years has elapsed since the last structural evaluation (Bridge-Culverts exempted). The structural evaluation shall include a seismic evaluation.

A structural evaluation may also be required as a result of the following:

- Recommendations resulting from field inspection due to concerns associated with deterioration or behaviour of primary components
- Following a significant and unanticipated event such as an earthquake, an accident or an extreme environmental condition
- Significant changes in the applicable bridge codes or highway load regulations
- A vehicle permit request for authorization to pass special loads.

Structural evaluation shall be carried out in accordance with the latest *CAN/CSA-S6 Canadian Highway Bridge Design Code* (CHBDC) and/or other approved Canadian regulatory codes in effect at the time. Provincial requirements shall be taken into account in the evaluation, when applicable. A Condition Inspection may be required prior to carrying out a load-capacity evaluation of the related structure.

The structural evaluation includes a statement on the general assessment of a structure's load-carrying capacity. This assessment is based on the condition of the bridge, individual components, materials, and functional constraints.

7.3 Documentation and Reporting

7.3.1 Inventory Listing

The DG, Professional and Technical Service Management (PTSM), shall maintain a current record of all bridges under the custodianship of PWGSC. The record shall include a summary of all comprehensive detailed, general and underwater inspections completed, planned, underway, and required in the near future.

The regional offices shall maintain an inventory of their bridge inspection reports, which shall include records of bridge design notes, computer aided design drawings, as-built plans, specifications, and shop drawings, including information on all repairs and rehabilitation work undertaken on the bridges.

The regional offices shall make these records available to the National Office upon request. Records shall also be made available to consultants contracted to carry out inspections and/or for the purposes of bridge analysis and structural evaluation.

7.3.2 Inspection Reports

Copies of all final inspection reports as listed in Table 1, including Comprehensive Detailed Inspections, General Inspections, Underwater Inspections, Special Inspections (by an engineer), Specialized Component Inspections, along with structural evaluations

and inspections undertaken during emergency situations, shall be submitted to the National Manager, Structures and Engineering Assets, PTSM, by **March 31** of the year following the calendar year of inspection, evaluation, and/or emergency situation.

Refer to the BIM for inspection report requirements. In addition, the Comprehensive Detailed Inspection reports shall include a recommended 10-year management plan to mitigate the deficiencies, such as remedial measures, proposed studies or recommended monitoring of specific components. The management plan shall include an estimation of costs. The heritage value of the structure shall be considered when making recommendations and prior to an intervention on the bridge.

The Comprehensive Detailed and General Inspection reports shall include a summary of all work completed for each structure during the year since the last inspection.

Any serious accident reported on the bridge and resulting significant damage to the structure, serious injury, or fatality since the last inspection shall be recorded in the inspection report.

The Comprehensive Detailed Inspection report shall address any issues related to the structure regarding single load path system, fracture critical details or details prone to fatigue.

All final inspection reports submitted by private sector consultants shall be signed and sealed by a Professional Engineer.

The submitted final report shall be accompanied by the *Review Checklist - Bridge Inspection Report* (see Annex B). PWGSC regional personnel shall use this checklist to assist their review of the inspection report to ensure that it meets BIM requirements. The checklist shall be signed by the PWGSC Regional Engineer responsible for the review and acceptance of the final report.

7.3.3 Inspection Summary Reports

The annual *PWGSC Bridges Inspection Summary Report* is intended to provide senior management with an overview of the condition of all PWGSC bridges as of year-end (March 31).

The office of the DG, PTSM, shall compile the *Bridge Inspection Summary Report* each year. The summary report shall list all bridges inspected during that year, including the type and extent of inspection, a summary of inspection findings, and related recommendations to mitigate the deficiencies. The summary report shall also include any structural evaluations completed and emergency situations managed during the year.

This information shall be provided by the regions to PTSM by March 31 for incorporation into the summary report. The summary report shall include a table listing

the current and future requirements in terms of Comprehensive Detailed Inspection, General Inspection, and Underwater Inspection, as set out in rows 1, 2, and 4 of Table 1.

Copies of the final summary report shall be submitted to the Director General, Engineering Assets Strategy Sector (DG, EASS); the Director General, Professional and Technical Service Management (DG, PTSM); and the Regional Directors General.

7.4 Inspection Exemptions

A Region can request an exemption from doing an inspection or part of an inspection. The request is to be submitted along with the supporting documentation and justification, to the Director General, PTSM, for approval through the office of the Director General, EASS, in accordance with the *Engineering Assets Portfolio Risk Assessment Procedure*.

Situations that may constitute a valid reason for an exemption include, but are not limited to, the following:

- A bridge undergoing a major rehabilitation and requiring detailed inspections in order to prepare the construction documents. These inspections would be of greater detail than that required by the Comprehensive Detailed Inspection.
- Unsafe underwater conditions

7.4.1 Exemption Process and Timelines

A multi-year exemption is not permitted. An exemption can be requested on an annual basis and must be evaluated for approval every year. Requests for exemption shall be made as early as possible to allow sufficient time to assess the request.

Should a request for an exemption not be approved, the subject bridge shall be included in the inspection program as per the schedule outlined in Table 1.

7.5 Emergency Situations

An emergency exists when a bridge is in imminent danger of failure or collapse, when a primary structural component has failed, when a major environmental event such as an earthquake or major flooding has occurred, or when any other situation has arisen that poses immediate danger to persons or property. If an emergency situation is discovered while carrying out an inspection and it is determined that immediate action is required to ensure public safety, site or field operational personnel shall ensure that the Regional Director and Manager, or their representatives, are notified immediately.

7.5.1 Emergency Response Team

The Emergency Response Team shall be comprised of the regional representatives or their delegated representatives, and representatives from any of the following:

- Director/Regional Manager – Professional & Technical Services

- Director General, EASS and/or
- Any persons within or outside the department who may be deemed capable of assisting.

The Emergency Response Team shall determine what appropriate action is required. This may include but is not limited to: bridge closure, assessment of damage or deterioration, technical resources required (in-house or private sector), repair strategy, load restrictions and whether a detailed structural design and contract drawings for tendering are required.

The Emergency Response Team shall advise the appropriate law enforcement agencies, Provincial Authorities, Municipal Authorities, National Call Service Center, PWGSC Regional Communication Office and other stakeholders.

The Emergency Response Team shall determine the need for, and location of, a temporary bridge, and any other aspect of the emergency that requires immediate action.

If the Emergency Response Team determines that a structural design and formal contract package should be prepared, then it shall be the responsibility of the DG, EASS, to ensure that funding is available for the preparation of the detailed design drawings and contract documents, and to ensure that the work is carried out expeditiously.

Assistance, where required shall be given by the National Office, PTSM, and the Real Property Contracting Office.

The DG, EASS, in consultation with the appropriate Regional Director General, is responsible for preparing a briefing note to the ADM, RPB, Deputy Minister, and/or Minister advising of the emergency situation and remedial action taken or planned in accordance with DP009, Critical Incident Reporting Policy.

8. RESPONSIBILITIES

The Director General, PTSM, is responsible for the following:

- Ensuring national consistency, implementation, and monitoring (annually reviewing four Comprehensive Detailed Inspection Reports for BIM compliance) with regard to the *Bridge Inspection and Evaluation Procedure*;
- Providing functional direction and advice
- Providing national oversight and quality management of the application of the procedure
- Providing the *Bridge Inspection Summary Report* as per Section 7.3.3
- Reviewing and approving exemption requests in consultation with the DG, EASS
- Maintaining a current record of all bridges under the custodianship of PWGSC
- Providing an updated Bridge Inspection Schedule annually

The Director General, EASS, is responsible for the following:

- Ensuring the implementation of the procedure at the regional level
- Ensuring that an appropriate asset management framework is in place nationally
- Approving program funding
- Reviewing exemption requests in consultation with the DG, PTSM

Regional Directors/Managers, Professional & Technical Services (PTS), are responsible for the following:

- Implementation of the inspection and evaluation procedure
- Managing, funding, and scheduling inspections to assure timely completion within operational requirements
- Assuring the quality of the final inspection reports
- Submitting final inspection reports to the National Office, PTSM
- Taking follow-up actions required to assure public safety and to protect investment
- Submitting requests for exemptions to the DG, EASS

9. DEFINITIONS

Bridges: Bridges are structures that provide a roadway or walkway for the passage of vehicles, pedestrians, or cyclists across an obstruction, waterway, gap, or facility, and are greater than 3.0 metres in span.

Qualified Bridge Engineer (QBE): A qualified bridge engineer is a Professional Engineer with civil engineering background and a minimum of five years' experience in the design, construction, maintenance, and inspection of bridges. The bridge engineer shall have successfully completed a bridge inspection course approved by a provincial authority or equivalent. The bridge engineer shall be trained in applicable safety regulations including confined space entry and the use of special equipment as applicable to meet specific inspection requirements.

Bridge Inspector: A bridge inspector is a technologist or technician with civil engineering (structural) training and a minimum of five years' experience in the construction and inspection of bridges. The inspector shall have successfully completed a bridge inspection course approved by a provincial authority or equivalent. The inspector shall be trained in applicable safety regulations including confined space entry and the use of special equipment as applicable to meet specific inspection requirements.

Qualified Specialist Engineer: A qualified specialist engineer is a Professional Engineer with a minimum of five years' related experience in the design, manufacturing, maintenance, and inspection of the specific equipment to be inspected. The specialist engineer shall have experience in the applicable industry codes, standards, and inspection practices. The specialist engineer shall be trained in applicable safety regulations including confined space entry and the use of special equipment as applicable to meet specific inspection requirements.

Fracture Critical member (per CHBDC): member or portions of members, including attachments, in a single load path structure that are subject to tensile stress and the failure of which can lead to collapse of the structure.

Fatigue (per CHBDC): initiation of microscopic cracks and propagation of such cracks into macroscopic cracks caused by the repeated application of load.

Single load path structures (per CHBDC): a structure in which failure of a single structural component could lead to a total collapse.

Load-posted structure: The load rating is a measure of a bridge live load capacity. The bridge is posted for its reduced capacity when the load rating falls.

10. REFERENCES

[Department of Public Works and Government Services Act](#)

RPB Bridge Inspection and Evaluation Policy

PWGSC Bridge Inspection Manual

RPB Dam Inspection and Evaluation Policy

<http://source.tpsgc-pwgsc.gc.ca/bi-rp/docs/ma/ma227-eng.html>

CAN/CSA-S6 - Canadian Highway Bridge Design Code

Engineering Assets Strategy Sector, Engineering Assets Portfolio Risk Assessment Procedure

PWGSC DP 007 - Health and Safety Policy

<http://publiservice.tpsgc-pwgsc.gc.ca/policy/text/p007-e.html>

PWGSC DP 009 - Critical Incident Reporting Policy

<http://publiservice.tpsgc-pwgsc.gc.ca/policy/text/p009-e.html>

PWGSC DP 016 - First Aid

<http://publiservice.tpsgc-pwgsc.gc.ca/policy/text/p016-e.html>

PWGSC DP 073 - Occupational Health and Safety – Construction

<http://publiservice.tpsgc-pwgsc.gc.ca/policy/text/p073-e.html>

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Canada Labour Code, Part II

http://www.hrsdc.gc.ca/eng/labour/health_safety/overview.shtml

Canada Occupational Health and Safety Regulations

<http://laws.justice.gc.ca/en/L-2/SOR-86-304/index.html>

11. ATTACHMENTS

Annex A: Types of Inspections

Annex B: Review Checklist - Bridge Inspection Report

12. ENQUIRIES

Please direct enquiries about this procedure to the Director General, PTSM, RPB, PWGSC

Please direct enquiries about this procedure that are of a technical nature to the National Office, Structures and Engineering Assets, PTSM, RPB, PWGSC.

Annex A: Types of Inspections

A1. Comprehensive Detailed Inspection

The Comprehensive Detailed Inspection consists of an in-depth close-up examination of all components of a structure, including components that may normally be below the water level but are exposed at the time of the inspection.

The inspection and evaluation process shall include a preliminary analysis of options and prioritize the recommendations for repair, rehabilitation, strengthening, replacement, and/or reconstruction, with life cycle cost considerations.

As per Table 1, a scheduled Comprehensive Detailed Inspection shall be performed by qualified and experienced bridge engineering personnel on all PWGSC bridges at intervals not exceeding two years (i.e., conducted every other year, alternating with a General Inspection), and on underwater components not exceeding four years. Interim inspections may be required for any bridge with known deficiencies, specialized functional mechanisms, or operational critical conditions.

Movable bridges shall have a Comprehensive Detailed Inspection annually (underwater components not exceeding 4 years).

A Comprehensive Detailed Inspection may also be carried out under circumstances which may include, but are not limited to:

- Prior to a major repair or rehabilitation of a structure
- Prior to approval of a load restriction or permit for the passage of special loads

A2. General Inspection

The General Inspection consists of a general visual inspection of the structure or a detailed inspection of structural components with known deficiencies. General Inspections must be performed by qualified and experienced bridge engineering personnel as per Table 1.

A condition rating of the components shall be assigned according to the procedures described in the BIM. The type of annual inspection will depend on factors such as importance, operational functions, age, condition, and intended maintenance of the structure.

The General Inspection shall be undertaken every other year alternating with the Comprehensive Detailed Inspection.

A3. Maintenance Inspection

The Maintenance Inspection consists of general visual observations by field maintenance personnel for maintenance-related purposes. The Maintenance Inspection is intended to identify obvious defects such as missing signs, graffiti, potholes, settlement, heaving,

pop-outs, safety concerns, lighting or equipment malfunction, damage resulting from an accident, vandalism, and unusual events. Maintenance Inspection reports must be kept at the regional and/or local offices.

Any significant defects/deficiencies or unusual events that pose imminent danger to the structure and public safety must be reported immediately to the Regional Manager. The Regional Manager must then take the necessary remedial actions to address the situation in a timely manner.

A4. Specialized Component Inspection

Specialized components include mechanical, electrical, hydraulics and cables associated with moveable bridges, cable-stayed, and suspension bridges. These components should be inspected annually by a Qualified Specialist Engineer.

A5. Monitoring Inspection

The Monitoring Inspection is intended to study and document a component's deficiency/performance over a specified period of time, generally on a predefined schedule. The inspection may include on-site observations and/or field measurements with respect to expansion joint gaps, settlements, translation or rotation of a bearing, crack widths and lengths in concrete or steel, scour, corrosion monitoring, etc.

Photographic records of on-site field observations should be maintained to allow comparisons of changes in condition over a period of time. Progressive records of any field measurements should also be maintained.

Monitoring Inspections must be undertaken by trained and qualified personnel under the direction of a Qualified Bridge Engineer as per Table 1.

A6. Special Inspection

A Special Inspection is an unscheduled visual inspection that shall be carried out when deemed necessary by a regional office, either during or immediately following a significant event or at the discretion of the Regional Manager. It shall be performed by experienced maintenance personnel and/or qualified bridge inspectors, engineers, and/or specialists.

A Special Inspection may initially be undertaken by maintenance personnel to investigate obvious defects or changes to a structure. Bridge engineers will then be called in to ascertain the extent and implications of any damage to the structure and to document findings and recommendations.

Significant events requiring a Special Inspection include, but are not limited to, the following:

- Vehicle/vessel collision with a structure
- Component distress/failure
- Unusually high spring run-off

- Heavy rainfall event in the catchment area
- Prolonged periods of extreme temperatures
- Significant earthquake (see note)
- Concerns as a result of failure of a similar structure/component elsewhere
- Unusual permit loads
- Other special circumstances

Note: Regions shall identify the specific triggers required and applicable to each asset within their jurisdiction based on the condition and location of the asset. As a minimum requirement, after a seismic event the following triggers shall require an asset, within the specified distance, to undergo a Special Inspection:

- Earthquake of a magnitude Richter 5 or more within 75 km from the reported epicentre
- Earthquake of a magnitude Richter 6 or more within 150 km from the reported epicentre
- Earthquake of a magnitude Richter 7 or more within 300 km from the reported epicentre
- Reports of damage (by PWGSC, media, or other source)
- Request from the Regional Director or Regional Director General, Professional & Technical Services

A7. Condition Inspection

The Condition Inspection is intended to assist in the assessment of the on-site state and performance of a structure as a whole as well as its individual components to determine the safe load-carrying capacity of the structure. A Condition Inspection shall be carried out when more information is required in addition to that available from the Comprehensive Detailed Inspection. This may require additional destructive and/or non-destructive testing of materials as outlined in the Bridge Inspection Manual.

The Bridge Engineer in charge of structural evaluation shall review the available plans, repair history, and inspection data to assess the situation, and shall arrange to obtain the additional information required to assist in the structural evaluation of the bridge.

Annex B: Review Checklist – Bridge Inspection Report**Structure/Asset Name:****Location:****Date of Inspection:****Type of Inspection:****Note:** For a “NO” response, provide explanation under the “COMMENT” column.

ITEM NO.	ITEM	YES	NO	COMMENT
1	Signed and sealed by Professional Engineer			
2	Electronic copy and hardcopy included (bilingual in designated regions)			
3	Executive summary included			
4	Type of inspection identified, including limitations, if any (i.e., any components not inspected)			
5	Inspection team identified			
6	Inspection dates, times, and site conditions noted			
7	Inspection methodology consistent with type of inspection			
8	Means of access to components identified (see section 1.1.2.1 BIM)			
9	Inspection details conform to type of inspection			
10	Inspection forms conform to <i>Bridge Inspection Manual</i> (BIM) format or better			
11	Drawings/sketches/diagrams are complete, legible, and to appropriate scale			
12	Photographs (adequate number, size, and sharpness)			
13	Engineering/site work completed/in progress since last inspection			
14	Significant findings (deficiencies per current standards)			
15	Remedial measures (options and analysis)			
16	Key recommendations (priority, timing, cost estimates (class D or better))			
17	Ten-year management plan included (Comprehensive Detailed Inspection			

	only)			
18	Component ratings (PCR* and MCR* included for all components)			
19	Overall condition rating and functional ratings identified			
20	Comments related to any significant change in ratings from previous inspection			
21	Urgent repairs identified on a timely basis and implemented. (see sec. A3)			
22	Additional engineering activities recommended			
23	Additional requirements identified			
24	Report sent to PTSM headquarters before March 31			
25	Report compliant with the bridge inspection policy and procedure			

* PCR: Performance Condition Rating

* MCR: Material Condition Rating

Checklist Completed By:

Reviewer's Name: *

Title:

Signature:

Date:

* PWGSC Regional Engineer Responsible for Acceptance of Inspection Report